Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-320-RC2, 2019

Geoscientific Model Development Discussions
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Interactive comment on "ORCHIDEE MICT-LEAK (r5459), a global model for the production, transport and transformation of dissolved organic carbon from Arctic permafrost regions, Part 1: Rationale, model description and simulation protocol" *by* Simon P. K. Bowring et al.

Anonymous Referee #2

Received and published: 15 May 2019

Major comments

The manuscript entitled "ORCHIDEE MICT-LEAK (r5459), a global model for the production, transport and transformation of dissolved organic carbon from Arctic permafrost regions, Part 1: Rationale, model description and simulation protocol" by Simon P.K. Bowring et al. developed a new feature, which includes the production, transport, and atmospheric release of dissolved organic carbon (DOC) from high-latitude

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permafrost soils into inland waters and the ocean. Permafrost contains huge carbon deposits, and although DOC transport is one of the most important components of the current global carbon cycle, this parameter is not explicitly simulated by land surface models. The model proposed in this study is the first of its kind that directly addresses unique permafrost soil biogeochemistry and its respective processes, fully encompassing the component, on a global scale. Thus, this new feature is definitely very interesting to readers and a great advancement in global carbon cycle research. Overall, the authors need to revise the manuscript before its publication. Although there are some minor issues, I recommend that this paper be published after the suggested revisions are addressed.

My major concerns are as follows: 1. All abbreviations should be spelled out at their first usage in the Abstract as well as the main text. For instance, ORCHIDEE MICT-LEAK should be spelled out in abstract as well as the main text, where this term is first mentioned. In addition, "IPSL", "DOC-C" and "MICT" are also not spelled out. Please check for all abbreviations throughout the manuscript and define them at the first usage.

2. Line 46: "... as the permafrost line migrates poleward over time." is incorrect, because there is no line in permafrost zone. However, there is boundary between continuous and discontinuous permafrost zones, and this boundary is slowly moving poleward over time. Please correct the phrase with respect to this suggestion.

3. Please edit English grammar throughout the manuscript more carefully. For example, in line 70 "To this end" is not clear. In addition, in line 62 "metabolising" should be "metabolizing".

My minor concerns are as follows: 1. Lines 50-51: "... , the majority as dissolved organic carbon (DOC)." is not clear. Please cite some references supporting the statement. For instance, in the headwater of the Lena River basin, Suzuki et al. (2006) showed that DOC was a dominant form of riverine organic carbon transport because

inorganic carbon and particulate organic carbon (POC) transport would be negligible on the basis of their observation data. Suzuki, K. et al. (2006), Nordic Hydrology, 37(3), 303-312, doi:10.2166/nh.2006.015.

2. Line 116-117: Please consider citing Suzuki et al. (2006).

3. Line 133-134: "... , and DOC concentration are affected at watershed scale by parent material and ground ice condition (O'Donnell et al., 2016)." The statement is incomplete, because DOC concentration is also affected by active layer depth as the frozen ground table limits water infiltration into deeper soil layers, as shown by Suzuki et al. (2006).

4. Line 169: "... and greater evapotranspiration (Zhang et al., 2009)." Please consider adding the study by Suzuki et al. (2018), wherein they have shown increasing evapotranspiration from the entire Arctic circumpolar Tundra due to summer warming. Suzuki, K. et al. (2018), Remote Sensing, 10(3), 402, doi:https://doi.org/10.3390/rs10030402.

5. Line 373: " ..., non-conservative canopy DOC production rate of 9.2*10-4 g DOC-C per gram ..." is not clear. Please rewrite more clearly.

6. Line 388: "3.5 Hydrological mobilisation of soil DOC" should be "3.5 Hydrological mobilization of soil DOC".

7. Line 396: "... (see sections 'soil flooding' and 'floodplain representation')." Please add the specific section numbers.

8. Lines 520-522: Please consider citing Suzuki et al. (2006), because they observed very large DOC transport from a headwater basin of the Lena River basin.

9. Line 654: "... , such as the photochemical breakdown of riverine OC, ...". Here, OC is not clear. Please define this and add explanation.

10. For equations (1)-(6): within the equations, variables are in italics but variables in

the main text are in normal font. Please modify these for consistency.

12. In Figure 1, letters (a)-(m) are too small to read. Please enlarge the letters.

13. In the caption of Figure 1, line 1254, "(d) Hydrological mobilisation of soil DOC" should be "(d) Hydrological mobilization of soil DOC"

14. In the caption of Figure 2, line 1277 "Blue dashed boxes" should be "Blue colored boxes".

Please also note the supplement to this comment:
https://www.geosci-model-dev-discuss.net/gmd-2018-320/gmd-2018-320-RC2-supplement.pdf

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